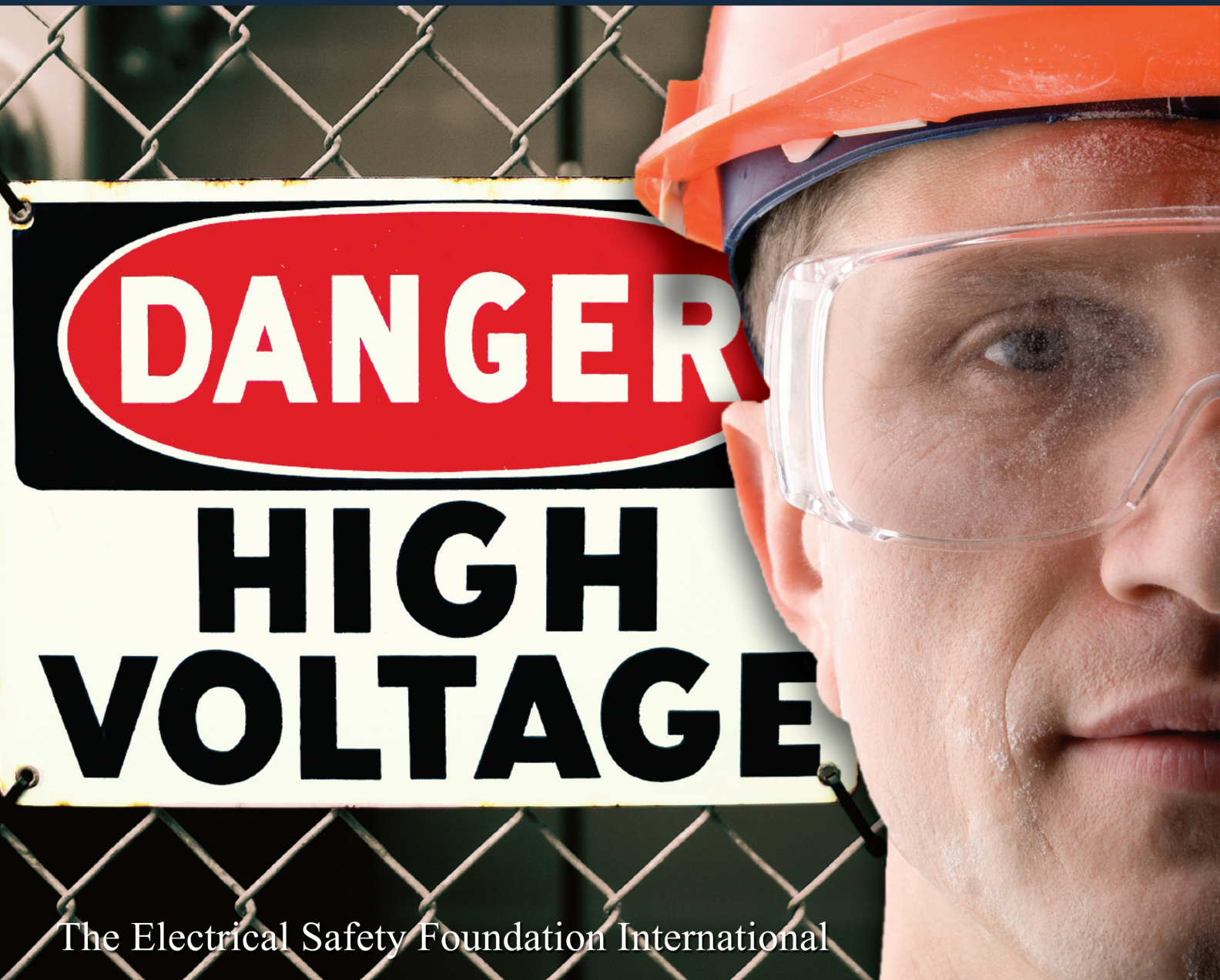


# ELECTRICAL SAFETY

IN THE WORKPLACE



The Electrical Safety Foundation International



### *Choose Safety*

*Most electrically-related fatalities and injuries could easily be avoided. Responsibility for your safety begins with you. Take steps to protect yourself everyday and make safety an integral part of how you do business.*

## < You have a choice:

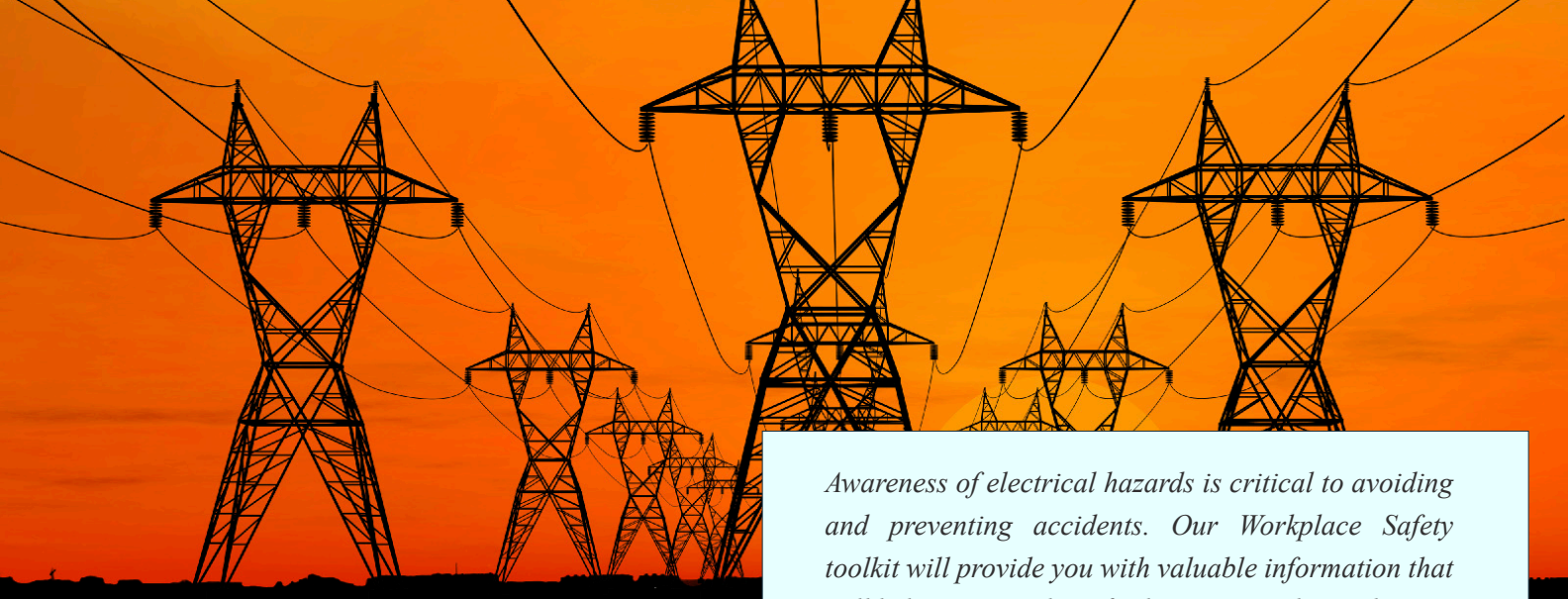
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Over the last 10 years, more than 46,000 workers have been injured from on-the-job electrical hazards. These injuries are not isolated to any one industry or field of work. They could happen to anyone when they least expect it. They could even happen to you. Fortunately, you have a choice to protect yourself from this threat.

### **Your choice matters.**

Every 30 minutes during the work day, a worker is hurt so severely from electricity that time off the job for recovery is necessary. Recovery from electrical shocks and burns is slow and painful. But it could be worse. More than 300 workers die from on-the-job electrical injuries each year. Your choice affects families, friends, colleagues, and YOU.





*Awareness of electrical hazards is critical to avoiding and preventing accidents. Our Workplace Safety toolkit will provide you with valuable information that will help you to make safe choices everyday and tips to create a safer work environment.*

## Here is how you can choose safety every day: >

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### **Deenergize – Deenergize – Deenergize**

Power down whenever possible. Working on energized equipment greatly increases your risk of injury and death.

### **Lockout/Tagout & Test Before You Touch**

Each worksite is dynamic. Following these key principles can prevent shock—or worse.

### **Arc Flash Prevention & Personal Protective Equipment (PPE)**

In the blink of an eye, an arc flash can forever change your life. Protect yourself by choosing the appropriate equipment for the job.

### **Job Planning & Work Permits**

Assess the hazards and define the tasks each job will entail. Never work energized unless it is absolutely necessary.

### **Who is ESFI?**

The Electrical Safety Foundation International (ESFI) is dedicated exclusively to promoting electrical safety. Established in 1994, ESFI proudly sponsors National Electrical Safety Month each May and focuses on raising professional safety awareness to reduce personal injury and death due to electrical accidents. With the support of many individuals, corporations, and organizations, ESFI is the leading advocate of electrical safety in the workplace.



### **Too Many Workers Put Themselves at Risk**

Each day, nearly 3 million professionals participate in work activities where lockout/tagout procedures should be used. Unfortunately, too many workers still put themselves unnecessarily at risk by working energized or neglecting to follow their company's lockout/tagout procedures. Failure to comply with the lockout/tagout standard is listed as one of the top OSHA violations year after year.

### **Deenergize — Be Proactive About Your Safety**

The number one way to prevent electrical injuries and fatalities is to deenergize the equipment being worked on. It may take a little more time and planning, but your life and your health are worth it. Be proactive about deenergizing equipment and taking steps to ensure that your work environment remains safe.

### **Lockout/Tagout Helps Prevent the Unexpected**

Lockout/tagout procedures safeguard workers from the unexpected energization, or startup, of machinery and equipment. They also can prevent the release of hazardous energy during service or maintenance activities.

### **Lockout/Tagout Could Save Your Life**

Always deenergizing and following established lockout/tagout procedures saves lives. Compliance with OSHA's lockout/tagout procedures prevents an estimated 120 fatalities and 50,000 injuries each year. Workers injured on the job from exposure to hazardous energy lose an average of 24 days of work to recuperation.





## Test Before You Touch Every Time: >

Every year, workers are injured or killed by circuits they thought were safely turned off. Simply shutting off the power is not enough—hazardous conditions can still exist. Make sure to always **TEST BEFORE YOU TOUCH**. You may not get a second chance to learn this important lesson.

Electrical hazards on the job can be avoided by following approved NFPA 70E and OSHA guidelines. Skilled employees trained in electrical safety procedures should make sure they understand and follow safety precautions. Those not trained to recognize and avoid electrical hazards, or not operating under the supervision of those qualified in electrical safety procedures, should avoid contact with electrical systems and equipment.

## Steps for Achieving an Electrically Safe Work Condition

- 1 Determine all possible sources of electrical supply to the specific equipment. Check applicable up-to-date drawings, diagrams, and identification tags.
- 2 After properly interrupting the load current, open the disconnecting device(s) for each source.
- 3 Wherever possible, visually verify that all blades of the disconnecting devices are fully open or that drawout-type circuit breakers are withdrawn to the fully disconnected position.
- 4 Apply lockout/tagout devices in accordance with a documented and established policy.
- 5 Use an adequately rated voltage detector to test each phase conductor or circuit part to verify they are deenergized. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Before and after each test, determine that the voltage detector is operating satisfactorily.
- 6 Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them. Where it could be reasonably anticipated that the conductors or circuit parts being deenergized could contact other exposed energized conductors or circuit parts, apply ground connecting devices rated for the available fault duty.

*Source: National Fire Protection Association (NFPA) 70E ©*



### *Arc Flash Explosions Happen Every Day.*

*While great advances are being made to improve equipment design and thereby reduce the number of arc flash incidences each year, there is still much to be done. Each year, 2,000 workers are admitted to burn centers for treatment of severe arc flash burns.*

## What is an Arc Flash? >

An arc flash is the sudden release of electrical energy through the air when a high-voltage gap exists and there is a breakdown between conductors.

An arc flash gives off thermal radiation (heat) and bright, intense light that can cause burns and other injuries. Temperatures have been recorded as high as 35,000°F. Exposure to these extreme temperatures burns the skin directly and ignites the clothing that you are wearing. High-voltage arcs can also produce considerable pressure waves by rapidly heating the air and creating a blast. This pressure burst, or arc blast, can hit a worker with grenade-like force and send metal droplets from melted copper and aluminum

electrical components shooting out at speeds up to 700 miles per hour, fast enough for the tiny shrapnel to penetrate your body.

### **What causes an arc flash?**

An arc flash can be spontaneous, or can result from inadvertently bridging electrical contacts with a conducting object. Other causes may include dropped tools, the buildup of conductive dust, or corrosion.





# Personal Protective Equipment is Your Last Line of Defense >

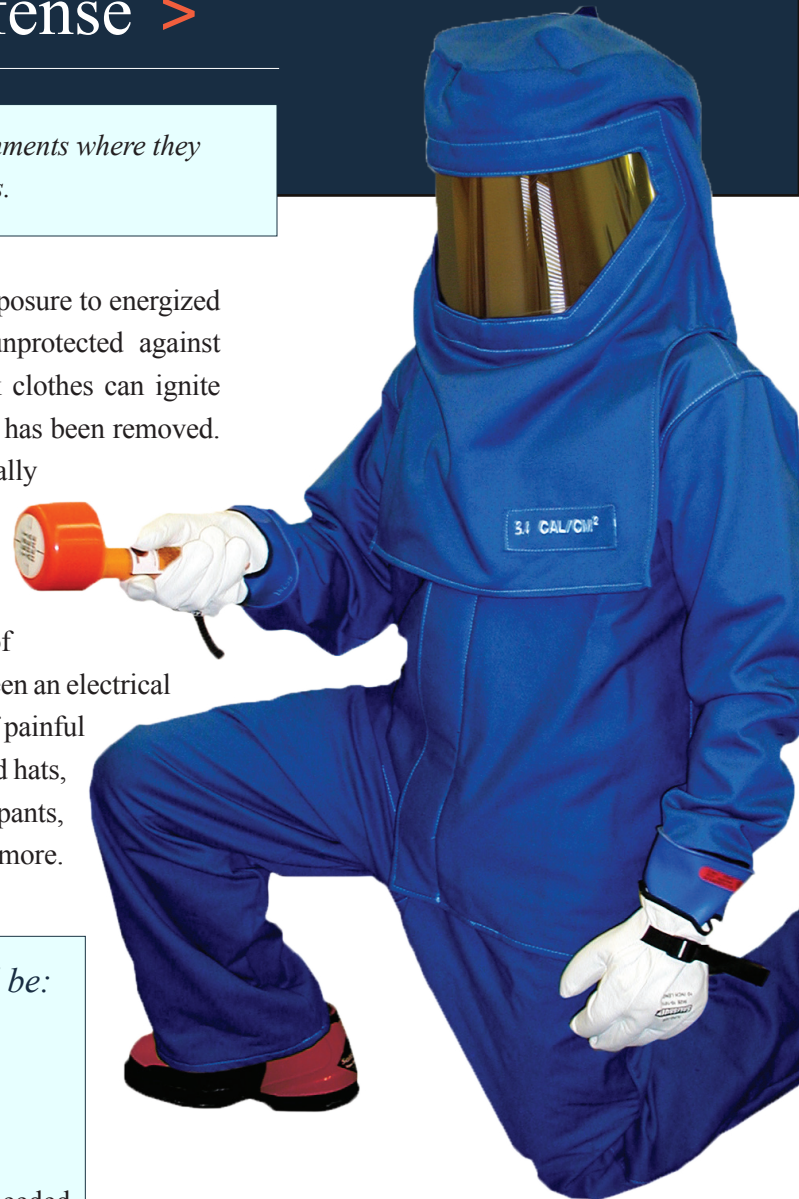
*Workers often find themselves in environments where they are exposed to unseen electrical hazards.*

In the event of a momentary electric arc, flash fire, or exposure to energized equipment, a worker can find himself completely unprotected against forces that cause severe or fatal injuries. Everyday work clothes can ignite and will continue to burn even after the source of ignition has been removed. Normal clothes will continue to burn until the fabric is totally consumed, or will melt and cause severe contact burns to the skin.

Personal protective equipment (PPE) is your last line of defense and will be the major factor in differentiating between an electrical event you walk away from and one that requires months of painful healing. PPE comes in many different forms, including hard hats, gloves, goggles, safety shoes, flame-resistant shirts and pants, safety glasses, face shields, fall protection equipment, and more.

*In order to make PPE work for you, PPE should be:*

- Appropriate for the hazard
- Worn as the outermost layer
- Worn CORRECTLY (i.e., zipped, buttoned, etc.)
- Repaired properly and removed from service when needed



# Safety Does Not Just Happen: >

*Planning for a job properly prevents mistakes and injuries from occurring. Safety on the job is not something that just happens; it should be an integral part of the planning process. Job briefings are a great way to include and encourage all crew members in the safety planning process. Job briefings can be held at the start of work shifts, as work tasks or hazards change, and as additional personnel arrive.*

## **JOB BRIEFING AND PLANNING CHECKLIST:**

### **IDENTIFY**

- |  |  |
|--|--|
| <input type="checkbox"/> The hazards                                     | <input type="checkbox"/> The shock protection boundaries                           |
| <input type="checkbox"/> The voltage levels involved                     | <input type="checkbox"/> The available incident energy                             |
| <input type="checkbox"/> Skills required                                 | <input type="checkbox"/> Potential for arc flash (Conduct a flash-hazard analysis) |
| <input type="checkbox"/> Any “foreign” (secondary source) voltage source | <input type="checkbox"/> Flash protection boundary                                 |
| <input type="checkbox"/> Any unusual work conditions                     | <input type="checkbox"/> Number of people needed to do the job                     |

### **ASK**

- |  |   |
|--|---|
| <input type="checkbox"/> Can the equipment be deenergized? | <input type="checkbox"/> Are backfeeds of the circuit to be worked on possible? |
| <input type="checkbox"/> Is a “standby person” required?   |   |

### **CHECK**

- |  |   |
|--|---|
| <input type="checkbox"/> Job plans   | <input type="checkbox"/> Safety procedures                          |
| <input type="checkbox"/> Single-line diagrams and vendor prints                  | <input type="checkbox"/> Vendor information                         |
| <input type="checkbox"/> Status board  | <input type="checkbox"/> Individuals are familiar with the facility |
| <input type="checkbox"/> Information on plant and vendor resources is up to date |   |

### **KNOW**

- |  |   |
|--|---|
| <input type="checkbox"/> What the job is                     | <input type="checkbox"/> Who is in charge |
| <input type="checkbox"/> Who else needs to know—Communicate! |   |

### **THINK**

- |   |  |
|---|--|
| <input type="checkbox"/> About the unexpected event...What if?            | <input type="checkbox"/> Install and remove grounds      |
| <input type="checkbox"/> Lock-Tag-Test-Try                                | <input type="checkbox"/> Install barriers and barricades |
| <input type="checkbox"/> Test for voltage—First                           | <input type="checkbox"/> What else...?                   |
| <input type="checkbox"/> Use the right tools and equipment, including PPE |  |

### **PREPARE FOR AN EMERGENCY**

- |  |   |
|--|---|
| <input type="checkbox"/> Is the standby person CPR trained?                          | <input type="checkbox"/> What is the exact work location?               |
| <input type="checkbox"/> Is the required emergency equipment available? Where is it? | <input type="checkbox"/> How is the equipment shut off in an emergency? |
| <input type="checkbox"/> Where is the nearest telephone?                             | <input type="checkbox"/> Are the emergency telephone numbers known?     |
| <input type="checkbox"/> Where is the fire alarm?                                    | <input type="checkbox"/> Where is the fire extinguisher?                |
| <input type="checkbox"/> Is confined space rescue available?                         | <input type="checkbox"/> Are radio communications available?            |

Source: National Fire Protection Association (NFPA) 70E ©



### *Working Energized*

*If energized work absolutely must be performed, using a work permit will help you prepare to face the work hazards ahead with a level of professionalism, productivity, and safety.*

## Work Permits are Safety Tools: >

An important part of planning for safety is using work permits. Work permits are used when live parts cannot be deenergized. Energized work should only be performed when deenergizing creates additional hazards or is infeasible due to equipment design or operational limitations. Additionally, work permits are not necessary when you are testing, troubleshooting, or voltage measuring – provided of course that you follow safe work practices and use the appropriate PPE.

When work must be done energized, work permits help everyone involved to think through the process and to make safety a priority. Work permits include detailed information about: how and why the work will be conducted; the shock and flash hazards involved; safe work practices and personal protective equipment (PPE) to be used; and the person responsible for authorizing the energized work.



### Five Ways an Energized Electrical Work Permit Can Help You

- 1 The permit requires you to define your work tasks and assess the hazards associated with the work involved.
- 2 The permit requires you to provide justification for the work to be done energized. Why aren't you working deenergized as required by OSHA?
- 3 After a hazard assessment, the permit aids in selecting the PPE necessary to protect you from shock and arc flash hazards.
- 4 The permit requires that boundaries be defined to keep unqualified workers out of harm's way, and that electrical workers be properly qualified for the specific energized work tasks.
- 5 Most importantly, the permit provides the approval necessary to perform the work energized. Requiring a signature is a powerful way to reinforce the primary requirement to work deenergized.



*Produced by ESFI, the Never Assume Electrical Safety Series DVD reinforces the safety training you have already received and expands upon key messages found in this booklet. Included on the DVD are video modules addressing the following topics:*

### **Overview of Standards & Regulations**

Promotes awareness of NFPA 70E and other industrial standards and codes regarding electrical safety in the workplace. This short segment explains their respective roles and applications in the industry.

### **Electrical Safety 101 for Construction & Industrial**

These two clips address the most common causes of electrical injuries in the industrial setting and on construction sites. They provide workers with general electrical safety information and safe work practices, and how to identify potential electrical hazards.

### **Job Planning for Qualified Persons**

This segment provides a summary overview of how to plan for safety whether working deenergized or not. It helps you to identify hazards, ask if the equipment can be deenergized, check job plans and safety procedures, think about the unexpected, and prepare for an emergency.

### **Deenergize & Test Before You Touch**

Finally, this short segment will show you the importance of always deenergizing. It explains the absolute importance of testing all conductors, every time for absence of voltage before starting a job.

*For more information on workplace safety, please visit ESFI's website at **[www.electrical-safety.org](http://www.electrical-safety.org)**.*

ESFI has a number of valuable print, audiovisual, and multimedia resources that are available right at your fingertips. On our website, you will find practical information and safety tips on a wide variety of topics, from holiday safety to protecting our supply chain from dangerous counterfeit electrical products. Additionally, ESFI prepares press releases and other materials that will help you to work with local media to reduce electrically-related fatalities and injuries and raise awareness of electrical dangers in the home and the workplace..





# *Never Assume*

## *Electrical Safety Series*

DVD  
VIDEO

Safety Awareness Videos for  
Electricians, Safety Directors,  
Construction Professionals and  
Facilities Managers



For information about how to obtain  
the Never Assume Electrical Safety  
Series DVD, contact ESFI at  
[info@esfi.org](mailto:info@esfi.org) or (703) 841-3229.



The Electrical Safety Foundation International (ESFI) is dedicated exclusively to promoting electrical safety. ESFI is a 501(c)(3) organization funded by electrical manufacturers and distributors, independent testing laboratories, utilities, safety and consumer groups, and trade and labor associations. ESFI sponsors National Electrical Safety Month each May, and engages in public education campaigns to reduce fatalities, injuries, and property damage due to electrical accidents.

To learn more about ESFI and electrical safety, visit our website at **[www.electrical-safety.org](http://www.electrical-safety.org)** or call (703) 841-3229.

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